Item # 8
SEMINAR IN LAW, ECONOMICS, AND ORGANIZATION RESEARCH
Professors Louis Kaplow, Lucian Bebchuk, Oliver Hart, and Kathryn Spier

Monday, April 12
**Pound 108**, 12:30 p.m.

“VC Inside Rounds as Rescue Financing: Theory and Evidence”

Brian Broughman and Jesse Fried*

*presenting
VC Inside Rounds as Rescue Financing: Theory and Evidence

Brian Broughman and Jesse Fried

Last Revised: April 4, 2010

Abstract

VC-backed startups typically invite outside VCs to negotiate and price the terms of follow-on financing rounds, in part to reduce conflicts between the entrepreneur and current VC investors over valuation. But some follow-on financings are structured as “inside” rounds -- only current VCs participate. One explanation for inside rounds is that they are used by VCs for self-dealing – to sell themselves stock at a low valuation. We offer a more benevolent “rescue financing” explanation for inside rounds. In particular, we show that existing VCs of a firm whose value has declined can benefit the firm and themselves by conducting an inside round at an inflated valuation rather than getting outside financing at a fair valuation. We then test our theory using a hand-collected dataset of 90 inside and outside rounds from Silicon Valley startups sold in 2003 and 2004. We find considerable evidence consistent with the use of inside rounds for rescue financing, and little evidence of their use for self-dealing.

JEL Classifications: G24, G32, G33, G34, K12, K20, K22, M13

Keywords: Venture capital, dilution, corporate governance, opportunism.

For helpful conversations and comments on earlier versions of this paper, we are grateful to Robert Bartlett, Sascha Becker, Ola Bengtsson, Tom Chang, Paul Gompers, Jim Greiner, Darian Ibrahim, Louis Kaplow, Kate Litvak, Eric Rasmussen, Jeff Stake, seminar participants at the University of San Diego, Vanderbilt, the 2008 Law and Entrepreneurship Retreat, the University of Cincinnati, the University of Wisconsin, the 2009 American Law and Economics Association annual meeting, the 2009 Law and Society Association annual meeting, the 2009 Midwest Law and Economics Association annual meeting, and the 2009 Conference on Empirical Legal Studies. We would also like to thank Albert Chang, Jennifer Su, Bruce Sun, and Fennie Wang for valuable research assistance. VentureReporter.net provided access to their database of mergers and acquisitions. This project was generously supported while the authors were affiliated with Berkeley Law School by a grant from the Kauffman Foundation through the Lester Center for Entrepreneurship and Innovation at UC Berkeley. We thank the many entrepreneurs who agreed to provide data for our research.
I. Introduction

Venture capitalists (VCs) play a critical role in the financing of high-risk, technology-based startup companies, investing billions of dollars annually in these businesses (Gompers and Lerner, 1999; NVCA 2009). Startups do not typically receive all of their VC financing at once. Rather, after the initial financing round, additional financing is provided in one or more “follow-on” rounds, each of which is separately negotiated and priced (Gompers, 1995).

Most follow-on financings are structured as outside rounds: the largest investor in the round is a new VC, and that VC negotiates terms with the startup (Lerner, 1994). Bringing in a new investor can mitigate conflicts between the entrepreneur and existing VCs over the value of the firm by having a third party negotiate pricing (Admati & Pfleiderer, 1994; Lerner, 1994; Brander, et. al., 2002), expand the startup’s contact network (Hochberg, Ljungqvist, and Lu, 2007), and improve fund diversification (Tian, 2008).

Inside rounds, in which only existing VCs participate, are less common, although they appear to be increasing in frequency (Bengtsson and Sensoy, 2009). Some commentators suggest that VCs could use inside rounds to engage in self-dealing by exploiting their power in the startup to sell themselves cheap stock (Klausner & Litvak, 2001; Gilson, 2003). In fact, many of the lawsuits filed by entrepreneurs allege that VCs used an inside round to dilute the entrepreneur (Atanasov, Ivanov & Litvak 2008). But little is known about whether the use of inside rounds for self-dealing is widespread (Klausner and Litvak 2001).

We propose an alternative, more benevolent explanation for the use of inside rounds, which we call “rescue financing.” We offer a model that demonstrates that, when a firm’s value has declined since its last financing, the firm’s current VCs are sometimes better off conducting an inside round at an inflated valuation than accepting financing from an outside VC at the firm’s actual value.

Our explanation for inside rounds builds on the fact that there are various costs associated with a “down-round” financing -- a financing at a lower valuation than the previous round. A down-round will trigger anti-dilution rights held by the firm’s existing VCs (Bartlett, 2003). The triggering of these rights, which substantially increase the existing VCs’ proportional ownership of the firm, typically leaves too little equity for the entrepreneur and other employees. Thus, anti-dilution dilution rights almost always must be renegotiated in a down round (Mahoney, 2002). Such renegotiation can be costly and time-consuming, particularly when existing VCs have different

---

1 VCs’ power over other participants in the startup comes from their contractual rights to block financings, expenditures, and corporate transactions (Fried and Ganor, 2006), as well as their seats on the startup’s board, where they often constitute a majority (Broughman and Fried 2010, Kaplan and Stromberg 2003).

2 In one of the few self-dealing cases that actually went to trial (Kalashian v. Advent, 1997) a firm’s VCs, in control of the board and holding over 90% of the firm’s stock, conducted an inside financing round at $0.005 per share, reducing the founders’ proportional ownership from 8% to 0.007%. Several years later, the VCs took the firm through an IPO and the stock price reached $70 per share. The founders sued, and after a weeklong trial (but before a verdict was delivered) the VCs settled the case for $15M (King, 1997).

3 Litigation by entrepreneurs against VCs for self-dealing is rare. But the infrequency of litigation could indicate either that VC self-dealing is constrained by threat of liability or reputational harm (Black & Gilson, 1998; Gilson, 2003; Smith, 1998, 1999; Suchman & Cahill, 1996; Atanasov, Ivanov & Litvak 2008; Broughman, 2009), or substantial impediments to bringing a lawsuit against VC investors (Fried and Ganor, 2006).
anti-dilution rights (Bartlett, 2006). Down rounds can also demoralize employees and may send a negative signal to the labor and investment markets.

When a firm’s value has declined since the last round, these down-round costs will be reflected in the terms offered by an outside VC proposing an investment. Existing VCs will thus bear, through their earlier investment in the firm, a large fraction of the down-round costs. A financing round at an inflated valuation would reduce (or eliminate) these down-round costs. In some cases, existing VCs may thus be better off doing the financing themselves at a high price. Although existing VCs would overpay for their new shares in this inflated-value financing, their old shares will be worth more than they would be in an outside round at fair valuation. First, the old shares capture some of the value transferred to current shareholders in the inflated-value inside round. Second, the old shares avoid bearing some or all of the down-round costs that would arise in a fair-value round. Existing VCs will benefit from overpaying for their new shares when the increase in value of their old shares exceeds the premium paid for the new shares.

Our theory generates a number of testable predictions that are at variance with those predicted by the self-dealing explanation for inside rounds. The rescue theory predicts that (i) as actual valuations decline, firms are more likely to receive inside financing, (ii) inside rounds are likely to be made at inflated valuations and (iii) inside rounds are associated with lower rates of returns than outside rounds. In contrast, the self-dealing theory predicts that inside rounds are likely to be made at bargain valuations and associated with higher returns than outside rounds.

We find preliminary support for the rescue theory using a hand-collected dataset of 90 follow-on financing rounds from 45 Silicon Valley firms that were sold in 2003 or 2004. We first show that changes in exogenous factors likely to affect firm value influence the likelihood of a round being inside in the manner predicted by our theory. Our results suggest that a 20% decline in NASDAQ between financing rounds increases the likelihood by approximately 14% that the next financing will be structured as an inside round.

We then show that inside rounds tend to be done at higher valuations than outside rounds. We compare the valuation used in the final financing round of each firm to the best observable estimate of the firm’s actual value at the time – the firm’s subsequent sale price. Controlling for various factors, we find that the valuation used in inside rounds is on average twice as high (relative to the sale price) as valuations used in outside rounds. Finally, we calculate the rates of returns on all 90 follow-on rounds. We show that inside rounds in our sample on average have a significantly lower rate of return – by about 30% to 40% - than outside rounds.

Interviews with the 45 entrepreneurs of the firms in our sample confirm that most of the inside rounds were driven by rescue motives, and not by self-dealing. Entrepreneurs generally reported that they were encouraged by the VCs to seek outside financing. Only three of the 24 entrepreneurs in firms using inside rounds reported that they believed the inside rounds were done at unfairly low valuations. One sued the VCs; the case settled for an undisclosed amount.

---

4 Consistent with the view that renegotiation of VCs' cash-flow rights is difficult, Bengtsson & Sensoy (2009) find that “major renegotiations of previous round contracts are rare.”

5 A down-round may also reduce the apparent performance of the VCs’ fund, making it more difficult for them to raise the next fund (Lerner, 1994).

6 Brander et al. (2002) offer a model in which inside rounds are used by existing VCs when they are confident in their valuation of the firm and know they are investing on favorable terms. Their model, like the self-dealing explanation, predicts that inside rounds will generally yield higher returns than outside rounds.

7 None of the entrepreneurs in the 21 firms that had only outside-round financings reported any problems with financing valuation.
Thus, while some of the inside rounds in our sample may have been used for self-dealing, the entrepreneurs’ own accounts suggest they were a small minority.

Of course, our sample firms were located in a particular area, Silicon Valley, at a period of time, when values were generally declining. We cannot rule out the possibility that, in other places or other periods of time, inside rounds are less frequently used for rescue motives. Our theory and evidence do, however, show that inside rounds may have benign motives and that in Silicon Valley during this period, inside rounds were more likely to reflect rescue motives than an attempt to exploit entrepreneurs.

Our analysis contributes to the literature on the structure of VC financings. The use of outside rounds has received considerable attention. Admati and Pfeiderer (1994) show that outside rounds can reduce conflicts over valuation between existing VCs and entrepreneurs. Hochberg, Ljungqvist, and Lu (2007) find evidence that outside rounds can increase the startup’s contact base. Tian (2008) suggests that outside rounds can improve fund diversification. Our paper provides the first theoretical explanation for why, notwithstanding these potential benefits to outside rounds, it may be desirable to use inside rounds, and offers evidence consistent with this theory.

Our paper also contributes to a better understanding of governance within private VC-backed startups before they are sold. While economists have studied the contracts VCs use when investing in startups (Kaplan and Stromberg 2003) and how they evolve (Bengtsson and Sensoy 2009) little is known about how VCs actually exercise control within these firms, including the potential for conflict around financing transactions (Klausner and Litvak 2001). Our study provides preliminary evidence suggesting that, while self-dealing may occur, VCs generally do not use their control rights to force through inside financings that benefit them at the expense of entrepreneurs.

The remainder of this paper is organized as follows. Part II presents our rescue theory of inside financing through a numerical example and a formal model. Part III describes our dataset. Part IV presents our findings. Part V (to be added) discusses the implications of our study.

II. The Rescue Theory of Inside Financing

In this section we describe our theory of inside financing. In Part A we illustrate the core intuition underlying our model with a numerical example of a startup firm seeking follow-on financing after its value has declined. We use this example to explain in more detail how anti-dilution provisions work and how they add costs to down-round financings. In Part B we set up our model and derive formal predictions. We conclude this section with testable hypotheses.

A. Anti-Dilution Rights, Down-Round Costs, and The Benefit of Inside Financing: A Numerical Example

We illustrate our theory with a narrative of a startup firm in the telecommunications sector (“Telecomm”) seeking follow-on financing after its value has declined.
1. Anti-Dilution Rights and Down-Round Costs

Shortly after Telecomm is founded, it receives $20M in Series A financing from a group of several VC funds. These funds invest $20M in exchange for 10 million convertible preferred shares priced at $2 per share. Each preferred share is convertible into common at a conversion price of $2 per share. Thus, each preferred share converts into one share of common. The 10 million Series A shares represent 50% of Telecomm's post-financing common stock (on an as-converted basis). The other 10 million common shares are held by Telecomm's founders and employees. Telecomm's "post-money valuation" is considered to be $40M (20 million shares outstanding x $2 per share). Telecomm's "pre-money valuation" at the Series A, which is simply the post-money valuation less the amount invested, is $20M ($40M - $20M).

The Series A investors use a standard financing contract that contains anti-dilution rights. Under the dilution rights, the Series A conversion price falls if Telecomm issues stock to future investors at a price of less than $2 per share. (This is equivalent to Telecomm having a pre-money valuation of less than $40M in a future round.) Assume that the Series A have "full-ratchet" anti-dilution rights, so that the Series A conversion price is reset to the price paid by the future investors for their shares. Thus if Telecomm subsequently issues Telecomm stock for $1, the conversion price for the Series A would drop to $1, and the Series A investors could convert each of their preferred shares into 2 shares of common.

Several years later, Telecomm has run out of money. It needs $20M of Series B financing. However, valuations in the telecommunications sector have declined substantially. Because valuations have declined, Telecomm know that Series B investors will insist on a pre-money valuation of less than $40M. In other words, any financing will be a "down-round."

Such a financing will impose various down-round costs on Telecomm and its investors. Most important, a down-round valuation would trigger the Series A VCs' anti-dilution rights. If the outside Series B investors' valuation of Telecomm is sufficiently low, it may not be mathematically possible to accommodate the Series A investors' anti-dilution rights and give the outside investors enough equity to induce them to invest.8 Even if the outsiders' valuation is high enough to make it mathematically possible to do a down-round while fully respecting the Series A anti-dilution rights, the full exercise of such rights will typically leave employees with too little equity. To preserve employees' incentives, the Series A investors must typically renegotiate their anti-dilution rights with each other and with Telecomm, a potentially drawn-out process. Telecomm's employees may also become demoralized and discouraged. A down round may also send a negative signal to the market. These renegotiation, demoralization and negative signaling costs will be reflected in the valuation given to Telecomm by the Series B investors.

Suppose that, taking these costs into account, outside Series B investors can be found to invest $20M for 40% of Telecomm, a $50M post-money valuation. This would be a down-round because the $30M pre-money valuation is less than the $40M post-money valuation following the Series A. And suppose that the valuation reflects $5 million in down-round costs; absent these down-round costs, Telecomm would be worth $55M (rather than $50M) after a $20M investment. The $5M in down-round costs could be avoided by doing the Series B round at a $60M post-money valuation. But the outside Series B investors will not invest at such a valuation, as that would involve overpaying for the stock.

---

8 See Bartlett (2003) for a discussion of this problem.
2. Inside Round as Rescue Financing

While the outside investors will not invest $20M for Series B shares at a $60M post-money valuation, the current Series A investors may be willing to do it. To see how the Series A investors may be better off overpaying for Series B stock rather than having it sold to outside investors on a $50M post-money valuation, we simplify by assuming that all shareholders – investors, founders, and employees- have the same type of cash flow rights: common stock. Thus, immediately before the Series B round, the Series A investors own 50% of Telecomm's common stock; employees own the other 50%. The Series B round will involve the issuance of additional common shares.

Consider the value of the Series A shares held by existing investors if the outside Series B investors invest $20M in a Series B round for 40% of Telecomm's common stock (a $50M post-money valuation). Because the Series A investors hold 50% of the equity before the Series B financing, they will have a 30% interest in Telecomm after the Series B. As Telecomm has a post-money valuation of $50M, the Series A shares will be worth $15M (30% x $50M).

Now suppose that the Series A investors invest $20M in a Series B round for 33% of Telecomm’s stock (a $60M post-money valuation). Because this would be an even round, the $5 million down-round costs associated with the outside round at $50M post-money valuation would be eliminated. Hence, Telecomm would be worth $55M post-money, $5M less than the valuation assigned in the round. The Series A investors will thus pay $20M for Series B shares worth $18.3M ($55M/3), an overpayment of $1.7M.

However, the Series A shares held by the Series A investors will be worth more than the $15M they would have been worth had an outside round been done at a $50M valuation. The Series A shares will represent 33% of Telecomm's common shares if the Series A investors purchase the Series B stock at a $60M post-money valuation. Telecomm will be worth $55M. The Series A shares will thus be worth $18.3M ($55/3), $3.3M more than if the Series B round had been an outside round.

On balance, the Series A investors are thus $1.6M ($3.3M - $1.7M) better off overpaying for Series B stock than having outside investors buy the Series B stock for its actual, lower value. In essence, the overpayment for the Series B transfers value to Telecomm's employees. However, the overpayment also reduces the Series A investors' share of down-round costs, and does so by an even larger amount. In this case, the existence of down-round costs makes it optimal for the Series A investors to conduct an inside round at an inflated valuation.

3. Overcoming Series A Hold-Outs

Of course, each of the Series A investors might prefer to sit out the overpriced B round and let the remaining Series A investors supply the Series B financing that will boost the value of the Series A shares. This creates a potential hold-up problem.

However, there are various ways that a majority of the Series A can induce other Series A investors to put up money for the Series B. The Series A financing contract will typically have a provision that enables a majority of the Series A to vote to convert all of the Series A into common

---

9 A down-round outside Series B financing, even if it reduces the value of the firm, may transfer value from Telecomm's founders and employees to the Series A investors to the extent the Series A investors' anti-dilution rights enable them to convert into more shares of common without putting up any more money. Thus, assuming that Series A investors' anti-dilution rights are not eliminated, the Series A investors will bear less than their proportionate costs of the down-round costs borne by Telecomm. We ignore this complication here.
at the current conversion price. If the “non-cooperating” Series A investors hold out, the “cooperating” Series A can threaten to convert all of the Series A preferred into common, and then issue themselves Series B preferred stock with a larger liquidation preference, leaving the non-cooperating Series A with common. This may induce the otherwise non-cooperating Series A investors to participate.

The charter may also have a “pay-to-play” provision applicable to the Series A. This provision would typically require Series A investors refusing to participate pro rata in a future financing (approved by a majority of the Series A investors) to convert to common stock at the conversion price in effect before the financing. If such a provision were not already in place, the cooperating Series A investors, along with other shareholders in the firm, could vote to amend the charter to put it in place such a provision so that it is effective for the Series B round. In short, there are typically mechanisms available to force all or most of the Series A investors to participate in a Series B at an inflated price.

B. MODEL

We now formalize the intuition developed in the numerical example above using a three-period financial contracting model.

- At Date 0, a wealth-constrained entrepreneur (“E”) forms a business (“Startup”) to pursue a new venture and obtains first-round (Series A) financing \( K_0 > 0 \) from a VC investor (“VC1”). E and VC1 divide monetary returns in a linear manner, \( \pi \) to VC1 and \( (1 - \pi) \) to E, where \( \pi \in (0, 1) \).\(^{10}\)

- At Date 1, Startup requires second-round (Series B) financing \( K_1 > 0 \) so that it can continue operations and be sold for a price \( V \) at Date 2.\(^{11}\) Series B financing is provided either by (i) VC1 (an “inside round”), or (ii) an outside VC investor (“VC2”) (an “outside round”). The second round financing contract gives the investor – either VC1 or VC2 – a fraction \( x_i \in (0, 1] \) of Startup’s equity in exchange for the investment of \( K_1 \).

The price for which Startup can be sold at Date 2 is known at Date 1. It depends on the state of nature (\( s \)) revealed after Date 0 and before Date 1, as well as any down-round costs.\(^{12}\) We will shortly describe these down-round costs and the bargaining process by which the Series B investor is chosen.

- At Date 2, Startup is sold to an acquirer and proceeds are distributed according to parties’ cash-flow rights. All parties are risk neutral. There is no discounting.

---

\(^{10}\) VCs typically hold convertible preferred stock (Kaplan & Stromberg, 2003) rather than common. The central point of our model, however, applies even if we relax the linearity assumption. As long as some portion of any surplus created by a new round of financing may be captured by an earlier round of VC investment, our basic intuition holds. The assumption of linearity makes it easier to specify how any gains from financing are distributed, but it is not necessary to create the basic dynamic.

\(^{11}\) For simplicity, we assume that absent such financing Startup will be worth $0.

\(^{12}\) Following the incomplete contracting literature, we assume the Date 1 state of nature is sufficiently complex such that it cannot be contracted over at Date 0 (Grossman and Hart, 1986). However, at Date 1 the parties can observe \( s \), and the second-round financing contract is priced accordingly. This assumption lets us focus on the second-round contract. It is also a realistic description of staged contracting practices in VC-backed firms (Gompers, 1995).
The time structure of the model is summarized in Figure 1.

**Figure 1: Timeline**

<table>
<thead>
<tr>
<th>Date 0</th>
<th>Date 1</th>
<th>Date 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• First round financing</td>
<td>• State of nature is revealed</td>
<td>• Firm sold. Cash flow rights paid out</td>
</tr>
</tbody>
</table>

**Down-Round Costs and Startup’s Value**

We now specify the potential down-round costs associated with the Series B financing and the price paid for Startup at Date 2. A down round occurs when the pre-money valuation at Date 1 is less than the post-money valuation at Date 0. On Date 0, after the Series A financing, the post-money valuation of Startup is $K_0 / \pi$. On Date 1, after the Series B financing, the pre-money valuation of Startup is $(K_1 / x_i) - K_1$. The Series B is thus referred to as:

- an up-round if $(K_1 / x_i) - K_1 > K_0 / \pi$
- a down-round if $(K_1 / x_i) - K_1 < K_0 / \pi$
- an even-round if $(K_1 / x_i) - K_1 = K_0 / \pi$

Our analysis suggests that there are various costs – such as renegotiation of anti-dilution rights and demoralization – to down round financing.

These costs may affect the sale price at Date 2. We define the sale price as

$$ V(x, s) = V_s - d(x) $$

Where $V_s$ is the value of Startup in state of nature, $s$, absent down-round costs, and the term $d(x)$ represents costs associated with down-round financing. We assume $d(x)$ is positive (and increasing in $x$) whenever the Series B is a down-round, but zero otherwise. Formally stated:

$$ d(x) \begin{cases} 0 & \text{if } x \leq \frac{K_1 \pi}{K_1 \pi + K_0} \\ > 0 & \text{if } x > \frac{K_1 \pi}{K_1 \pi + K_0} \end{cases} $$

To ensure a unique interior solution, we assume $d$ is continuous and differentiable in $x$, $d' > 0$ and $d'' > 0$ for all $x > \frac{K_1 \pi}{K_1 \pi + K_0}$. We assume that (absent down-round costs) financing always creates a surplus, and thus that $V_s > K_1$ for all states of nature.\(^{13}\) For ease of notation we sometimes refer to $V(x, s)$ simply as $V$.

**Series B Bargaining Process**

To predict when inside financing will occur in the Series B and on what terms we specify the bargaining process. Startup’s board controls the bargaining process and seeks to maximize value.

\(^{13}\) Startup is worth $0$ if it does not receive second round financing. Thus, the difference between $V_s - d(x)$ and $K_1$ can be seen as the social surplus of second round financing.
for its existing equity holders. Startup first solicits a financing offer from VC2. If VC2 offers financing, Startup seeks a better offer from VC1. If VC2 declines to invest, Startup seeks an offer from VC1.

Following the financial contracting literature (Aghion and Bolton, 1992) we assume perfect competition among outside investors at Date 1. Consequently, VC2 will offer a contract if there is a valuation that enables it to yields zero profit in expectation. VC1 will make a counteroffer (or offer, if VC2 declines) only if doing so makes VC1 better off. We consider three cases: (1) VC2 offers up/even round financing; (2) VC2 offers down-round financing; and (3) VC2 declines to offer any financing.

**Case 1: VC2 Offers Up/Even Round Financing**

There are no down round costs \( d(x) = 0 \) when VC2 offers financing at an Up or Even valuation. Given perfect competition, VC2 will set the post-money valuation at Date 1 equal to \( V_s \). VC2 will offer to invest for cash flow rights \( x_2 \) such that \( V_s = K_1/x_2 \).

**Proposition 1:** VC2 will offer an Up or Even round if and only if \( V_s \geq K_1 + K_0/\pi \).

**Proof:** Assume \( V_s \geq K_1 + K_0/\pi \). By substituting for \( V_s \) we see that \( (K_1/x_2) \geq K_1 + K_0/\pi \), which is by definition an Up round or an Even round. By contrast assume \( V_s < K_1 + K_0/\pi \). Substituting gives us \( (K_1/x_2) < K_1 + K_0/\pi \), which by definition is a down round.

**Proposition 2:** If VC2 offers financing at an Up or Even valuation, VC1 will not make a counteroffer.

**Proof:** If VC1 were to make a counteroffer it would be at a higher valuation \( x_1 < x_2 \). VC2’s proposal would give VC1 a payoff equal to \( (1 - x_2)\pi V_s \). If VC1 were to make a counteroffer it would receive \( (1 - x_1)\pi V_s + x_1 V_s - K_1 \). Proof by contradiction: assume VC1’s net payoff from inside financing is greater than its payoff if VC2 provides outside financing. It follows that:

\[
(1 - x_2)\pi V_s < (1 - x_1)\pi V_s + x_1 V_s - K_1
\]

Substituting \( x_2 V_s \) for \( K_1 \) into Eq. (2) and combining terms we find that:

\[
(x_2 - x_1)V_s < (x_2 - x_1)\pi V_s
\]

Eq. (3) is a contradiction since \( \pi \in (0, 1) \) and \( V_s > 0 \). Thus, we conclude that VC1 will not propose a counteroffer if VC2 offers financing at an Up or Even valuation.

**Remark:** Proposition 2 shows that when VC2 offers to invest at an Up or Even valuation, VC1 cannot improve its position by making a counteroffer. The basic intuition is straightforward. Because of perfect competition, the surplus from an outside round is divided entirely between VC1 and E – Startup’s preexisting equity holders. If VC1 were to offer a higher valuation, it would receive a negative expected return on its Series B investment. To be sure, a higher valuation would increase the value of VC1’s Series A investment. However, the increase in the value of the Series A

---

14 Our results do not depend on the allocation of board seats, or other control rights, at Startup. The results would be identical if VC1 or Startup’s other shareholders controlled the bargaining process, as long as Startup could not be forced to accept worse terms from VC1 than would be offered by VC2.

15 We assume startup will not accept a lower valuation.
investment would always be less than the overpayment for the Series B shares because E captures some of the value transferred to current shareholders in the overpriced round, and a higher valuation does not reduce down-round costs. The net return to VC1 from offering a higher price would be negative.

**Case 2: VC2 Offers Down-Round Financing**

VC2 takes into account the cost of down round financing \([d(x) > 0]\) when pricing its offer. In this case, VC2 will set post-money valuation at Date 1 equal to \(V_s - d(x_2)\). VC2 will offer to invest for cash flow rights \((x_2)\) such that \(V_s - d(x_2) = K_1/x_2\).

** Proposition 3:** VC2 will offer a down round whenever \(V_s < K_1 + K_0/\pi\) and there exists \(x_2\) such that \(x_2[V_s - d(x_2)] \geq K_1\).

**Proof:** Assume \(V_s < K_1 + K_0/\pi\) and there exists \(x_2\) such that \(x_2[V_s - d(x_2)] \geq K_1\). Since \(V_s - d(x_2) = K_1/x_2\), it follows that \((K_1/x_2) < K_1 + K_0/\pi\), which is by definition an Down round. From Proposition 1 we know that if \(V_s \geq K_1 + K_0/\pi\) VC2 will offer an Up or Even round. And if there is no \(x_2\) such that \(x_2[V_s - d(x_2)] \geq K_1\) VC2 will not offer financing at all.

When VC2 offers a Down round, VC1 may propose a counteroffer, depending on the magnitude of down round costs. Because of its Series A interest, VC1 can participate at a higher valuation than VC2, and when down round costs are large, VC1 can increase its total payoff by making a counteroffer at a higher valuation.

To see this, let \(h(x_1)\) represent VC1’s combined payoff – from the Series A and Series B equity – if it proposes a counter-offer at Date 1:

\[
h(x_1) = x_1[V_s - d(x_1)] + \pi(1 - x_1)[V_s - d(x_1)] - K_1
\]

By definition \(h\) is a concave differentiable function over the range \([0, 1]\). Thus, we can solve for \(x_1^* \in (0, 1)\) which maximizes \(h(x_1)\) by taking the first derivative and solving for zero. Let \(x_1^*\) be defined such that:

\[
(1 - \pi)[V_s - d(x_1^*) - x_1^*d'(x_1^*)] - \pi d''(x_1^*) = 0
\]

The cash flow rights represented by \(x_1^*\) yields the highest payoff for VC1.

This allocation of cash-flow rights is important since it lets us identify when VC1 will make a counteroffer and on what terms. If VC2 demands cash flow rights greater than \(x_1^*\), VC1 will make a counteroffer at a post-money valuation equal to \(K_1/x_1^*\). The valuation represented by \(K_1/x_1^*\) effectively defines a tipping point. It is the point at which a change in valuation has the same marginal effect on VC1’s existing equity as its new equity.

** Proposition 4:** If VC2 offers Down-round financing, VC1 will:

1. make a counteroffer if and only if \(x_1^* < x_2\), and
2. if VC1 proposes a counteroffer it will set valuation equal to \(K_1/x_1^*\).

---

16 To see this note that \(h'' = -(1 - \pi)[2d' + xd''] - d''\) and by assumption \(d'' > 0, d' > 0, and \pi \in (0, 1)\). It follows that \(h'' < 0\).
Proof of part (i): VC1’s payoff function, $h$, is concave and takes its maximum value at $x_1^*$. If $x_2 \leq x_1^*$ VC1 would decrease its payoff by offering to invest at a higher valuation. If $x_2 > x_1^*$ VC1 would increase its expected payoff by offering to provide inside financing in exchange for cash-flow rights in the range $[x_1^*, x_2)$. Both results follow immediately from the concavity of $h$.

Proof of part (ii): This counteroffer valuation follows immediately from VC1’s payoff function. Provided $x_2 > x_1^*$, technically VC1 could improve its position by offering to provide inside financing in exchange for any cash-flow rights in the range $[x_1^*, x_2)$. By definition, however, the point $x_1^*$ would give VC1 the highest payoff, and since this is also the highest valuation for Startup there is no reason to invest on any other terms.

Remark: Proposition 4 specifies when VC1 will make a counteroffer and the terms of inside financing. In some down-round settings [when $x_1^* \geq x_2$] VC1 cannot improve its payoff by offering to invest at a higher valuation. Our analysis predicts that Down-rounds led by an outside investor will sometimes occur. However, in other down-round settings [when $x_1^* < x_2$] VC1 can improve its payoff by proposing a counteroffer at a higher valuation. Our analysis predicts that inside financing is more likely to occur as the costs of down-round financing increase.

Case 3: VC2 Declines to Offer Financing

If the costs of down round financing are sufficiently large, there may be no allocation of cash-flow rights that would give VC2 its required return. VC2 will refuse to invest if there is no $x_2$ such that $x_2[V_s - d(x_2)] \geq K_1$.

Even though VC2 declines to offer financing, VC1 may be able to provide inside financing. This is possible because VC1’s Series A claim – worthless without Series B financing – captures some of the value created by second round financing. VCV1 can invest at higher valuations and avoid some down-round costs that an outsider faces.

Proposition 5: Inside financing is feasible even though outside financing is not whenever $x_2[V_s - d(x_2)] - K_1 < 0 \leq h(x_1^*)$ for all $x_2 \in (0, 1)$.

Proof: By definition of $x_1^*$ the expression $x_2[V_s - d(x_2)] - K_1 < h(x_1^*)$ for all $x_2 \in (0, 1)$. It follows that there exists $K_1$ such that $x_2[V_s - d(x_2)] - K_1 < 0 \leq h(x_1^*)$ for all $x_2 \in (0, 1)$. Consequently, inside financing may be feasible even though outside financing is not.

Predictions

Our model leads to several testable predictions. First, inside financing is likely to be affected changes in firms’ actual values. Our model predicts that a firm will not receive inside financing if its value has not declined since the last financing round. However, if an outside investor proposes a down-round the firm’s insiders may be willing to make counteroffer at a higher valuation. Thus, inside rounds are more likely as values decline.

Second, our model predicts that the valuations used in inside rounds will be different than in outside rounds. Inside investors are willing to overpay for stock to reduce the costs a down-round financing imposes on their existing interests in the firm. Thus, when firms’ values have declined, the valuations assigned to firms in inside rounds will thus be higher, everything else equal, than the values assigned to firms in outside rounds.
Third, inside rounds will have a lower rate of return than outside rounds. This prediction is of course related to the second prediction – that inside rounds will occur at inflated valuations. If valuations used in inside rounds are too high, the returns on these rounds should be lower.

III. The Data

Standard VC databases, such as VentureXpert, do not generally provide the type of fine-grained data necessary to test the predictions of our model, such as valuations and actual returns to different financing rounds. Such data must be hand-collected.

We thus test the predictions of our rescue theory of inside financing using a hand-collected dataset of 90 follow-on rounds by 45 VC-backed Silicon Valley firms that were sold in 2003 and 2004. This section (i) explains how our data were gathered, (ii) addresses selection concerns, (iii) describes the firms in our dataset, and (iv) summarizes the terms used in follow-on financings.

A. Data Gathering

The data for this study was gathered in 2005-2007 from entrepreneurs in Silicon Valley as part of a larger empirical project on the internal governance of VC-backed firms sponsored by the Kauffman Foundation. The study collected information on conflicts between VCs and other participants in the startups around financings, replacement of the CEO, and the sale of the firm.

We obtained from VentureReporter.net a list of VC-financed firms located in California and sold to an acquirer in 2003 or 2004. We removed firms not located in or around San Francisco, San Jose, or Oakland (broadly defined as “Silicon Valley”), leaving a population of 193 firms.

For each firm we sought to locate and obtain data from one or more founders/executives (“entrepreneurs”) about the firm’s life – from formation to sale. We identified current business addresses for entrepreneurs of 141 of the 193 companies and contacted them. Entrepreneurs from 57 of the 141 firms agreed to provide us with data – a response rate of 40.4%. The information obtained, supplemented by publicly filed corporate charters, covers the lifespan of each firm. Among the data gathered were the state of incorporation, detailed cash-flow rights and control rights negotiated in each VC financing round, and the terms of sale. For this study on inside rounds, we removed 12 of the 57 firms, because they did not receive follow-on financing, they did not have a true exit event (one where cash or publicly traded securities was paid to the VCs), or we were unable to verify follow-on round valuations. We thus have an effective sample of 45 firms and 90 follow-on rounds of financing.\textsuperscript{18}

\textsuperscript{17} We used LinkSV to filter out firms not meeting these criteria <www.linksv.com>. LinkSV profiles all companies located in Silicon Valley (in or around San Jose, San Francisco, and Oakland) that received VC funding. Companies not appearing on LinkSV were removed from our sample.

\textsuperscript{18} Due to data limitations a relatively small sample size is common to studies of venture capital. The number of VC-backed firms in other projects using hand-collected data is 51 in Hsu (2004), 170 in Hellman & Puri (2002), 119 in Kaplan & Stromberg (2003), 132 in Cumming (2008), 50 in Broughman & Fried (2010), and 210 in Bengtsson & Sensoy (2009).
B. Selection Issues

Our sample is limited to Silicon Valley firms sold in 2003 or 2004. Factors unique to the Silicon Valley VC market, to this time period, or to firms that end up being acquired in private sales could limit the generalizability of our results. In addition, our sample consists only of companies whose entrepreneurs voluntarily responded to our request for information. There could be systematic differences between firms whose entrepreneurs responded to our inquiries and firms whose entrepreneurs did not. We sought to minimize such biases by soliciting data from every entrepreneur we could locate and offering confidentiality.

To test for selection bias, we use VentureXpert to compare the 45 firms in our sample to the full population of 193 Silicon Valley firms that were sold in 2003 and 2004. We were able to find a VentureXpert profile for 44 of the 45 firms in our sample, and 170 of the 193 firms in the total population. We can only compare firms that are included in the VentureXpert database. Using a difference of means test, we compare characteristics of the sample firms to the full population on three dimensions: (i) amount invested, (ii) number of investors, and (iii) year founded. We find no statistical difference between our sample and the population with respect to the amount invested and the number of investors. The only difference is that the firms in our sample were on average started slightly later than the rest of the population. These results are reported in the Appendix.

C. Sample Description

Our sample firms are 'high-tech' businesses, primarily in the biotech, software, telecommunications, and internet sectors (Panel A of Table 1). The concentration of firms in our sample is representative of VC financed firms generally (Kaplan and Strömberg, 2003 at 284).

At the time of sale, the firms in our sample had received an average of $44 million in VC funding, and had been operating for an average of approximately five years. The average sale price was $55 million, but there is considerable variance in exit outcomes. Some firms were essentially liquidated, yielding a sale price less than one million dollars, while several firms were sold for considerably over $100 million.

Sale proceeds are divided among preferred and common stockholders. Since we know the date of each financing round, the date of sale, and how the sale proceeds are allocated, we can calculate the VCs' internal rate of return (IRR) for each round of financing and for each firm. The average firm-level IRR for the VCs was 0.20. However, only 16 out of the 45 firms were sold for a profit, suggesting that the average IRR is skewed by a few highly profitable firms. Panel B provides descriptive statistics on the amount invested, years of operation, and sale price.

[INSERT TABLE 1 HERE]

---

19 The companies in our sample also received, on average $0.15 million in entrepreneur/family financing, and $0.45 million in angel financing. This is likely to understate the extent of angel financing, since any investor receiving preferred stock in a financing rounds that include at least one VC investor is treated as a VC investment for purposes of this paper.
D. Financing Round Characteristics

The 45 firms in our study received, on average, three rounds of VC financing (Panel A, Table 1). We document a total of 90 follow-on rounds of financing. We collect detailed information on each round of investment, including the composition of the investor group, the allocation of board control, the VCs’ cash-flow rights, and the valuation used in the financing. Table 2 defines variables used throughout the remainder of the paper and provides a correlation matrix.

[INSERT TABLE 2 HERE]

Inside vs. Outside

Our dataset includes a total of 26 inside rounds and 64 outside rounds. Inside rounds are typically smaller investments and are more common in later rounds of investment (Figure 1). Inside rounds are infrequently used prior to the collapse of the tech bubble in 2000 but are more common thereafter (see Figure 2 below).

[INSERT FIGURE 2 HERE]

Valuation

We record the valuation used in each round of financing. We use and report the nominal post-money valuation. The nominal valuation is equal to the VC’s investment divided by the fraction of common stock that the VCs are entitled to on a fully converted basis.

If the nominal pre-money valuation (post-money valuation less the amount invested) is higher than the post-money valuation of the previous round, the new round is considered an “up round”. If the nominal pre-money valuation is lower than the post-money valuation of the previous round, it is considered a “down round.” If the pre-money valuation on the new round is the same as the previous round’s post-money valuation, the round is called “even.” Our sample includes 45 up rounds, 14 even rounds, and 31 down rounds. As we explained earlier, a down round can give rise to significant costs.

[20] The number of financing rounds in our sample is consistent with findings of practitioner surveys. See e.g. VentureOne ‘Deal Terms Report’.

[21] Nominal valuation is the standard method of valuing VC-backed startups. Nominal valuation, however, implicitly assumes that the common stock held by entrepreneurs has the same value as the VCs’ preferred stock, even though preferred stock typically includes a liquidation preference and other rights that make it more valuable than common stock (Metrick 2007). To account for the value of these rights we also report valuation on an implied basis using an option valuation technique outlined in Metrick (2007) that derives a value for the firm based on the amount the VCs pay for their stock as well as the liquidation preferences, participation rights, and other features of the VC’s preferred stock. For purposes of calculating implied valuations, we use an annualized volatility for the VC industry of 89% (Cochrane, 2005). For details on this approach see Metrick (2007) at pages 252 – 287. The method of valuation - nominal or implied - does not affect our findings reported below. We ran all the regressions in Tables 4 and 5 (below) using both methods of valuation, and we found qualitatively similar results.
IV. Empirical Results

We operationalize and test our hypotheses. First, we explore whether, as predicted, declines in value affect the use of inside rounds. Then we compare the valuations assigned to inside rounds as opposed to outside rounds to determine whether there is evidence consistent with our hypothesis that inside rounds are made on worse terms. Third, we compare the rate of return on inside rounds to that of outside rounds to determine whether, as predicted, the returns on inside rounds are lower.

A. Declining Values and the Use of Inside Rounds

Our theory predicts that inside rounds are more likely to occur when a firm's value declines. A firm's value decline may decline either because of firm-specific factors (the performance of the firm's management and engineering team, etc.) or extrinsic factors, such as falling values in the overall market.

Because we are unable to observe a reliable measure of firm-specific performance, we focus on external factors that should affect a firm's value. We use as a proxy for market values the closing price of the NASDAQ national market, for which we have daily values. For each round of financing, we measure the closing price of the NASDAQ national market on the date of investment (NASDAQ). We then calculate the percentage change in this measure since the date of the last round of financing. Our theory predicts that a decrease in NASDAQ prices should increase the likelihood of down rounds and inside financing.

Figure 2 provides support for our predictions. The top portion of the diagram graphs the weekly NASDAQ closing price. The bottom portion shows the frequency of down rounds and inside rounds over time. When market prices were increasing (in the late 1990s) inside rounds were rarely used. However, after 2000, as NASDAQ prices fell, inside rounds occurred frequently. We find a similar trend with down rounds. Down rounds are more common after 2000.  

We estimate, using logit, the likelihood of inside financing as a function of the change in NASDAQ closing prices from the one round to the next. We set $NASDAQ_{t-1}$ as the closing price on the date of the prior round of financing, and $NASDAQ_t$ as the closing price on the date of the current round of financing. We define $\Delta\ NASDAQ (\%)$ as the percentage change and $\Delta\ NASDAQ$ as the absolute change in NASDAQ between the two dates.

Table 3 reports our results. In model (3-1) and (3-2) we report univariate logit results for $\Delta\ NASDAQ (\%)$ and $\Delta\ NASDAQ$ respectively. In model (3-3) and (3-4) we add additional control variables. We control for Round Number, which Figure 1 suggests may be correlated with the use of inside financing, and VC Control, which the self-dealing explanation suggests as a possible cause of inside financing. The change in NASDAQ has a significant negative effect in all models. A drop in NASDAQ increases the likelihood of inside financing.

---

22 Our theory suggests that some rounds that would have been done as down rounds at a fair valuation may be done as an even or up round to reduce down-round costs. Thus the number of reported down rounds is likely to understate the frequency with which firm values have fallen since the previous round.
Setting all variables to their median value we predict the marginal effect of a change in NASDAQ on the probability of inside financing. We find that a 20% drop in NASDAQ increases the likelihood of inside financing by about 14% (from 26% to 30%). While NASDAQ is certainly not the only factor driving the use of inside financing, it does have an economically meaningful impact.

**B. Round Valuation: Inside versus Outside**

Our theory predicts that inside rounds will have higher valuations (relative to the firms’ actual values) than outside rounds. Unfortunately, it is impossible to observe the 'true' value of a private company at the time of financing. To address this problem, we use the eventual sale price of the firm – negotiated at arm’s length between the buyer of the firm and the firm’s investors -- as a proxy for the firm’s 'true' valuation in the last round of financing.

The sale price may of course reflect events that did not occur until after the last round of financing. Consequently, the use of the sale price is not a perfect indicator of the firm’s actual value at the last financing. But we assume such distortions are randomly distributed (or controlled for in the regressions below), allowing the sale price to serve as an unbiased estimate of a firm’s value at the time of the last financing.

For each firm we compare the valuation assigned to the firm in the last round of VC financing (last round valuation) to the sale price. Our dependent variable is the ratio (Last Round Valuation)/(Sale Price) or ("LRV/SP"). The self-dealing theory for inside rounds suggests that inside rounds will be undervalued. By contrast, our theory predicts that LRV/SP will be systematically higher in Inside rounds as compared to Outside rounds.

Figure 3 illustrates the distribution of LRV/SP for inside rounds and outside rounds. Inside rounds often have an LRV/SP ratio exceeding 2 or 3. In contrast, in outside rounds LRV/SP is generally close to one. Consistent with our rescue financing theory, inside rounds appear to be overvalued relative to the ultimate sale price, while outside rounds are not.

To test the hypotheses in a multivariate setting, we estimate the following equation:

\[
\log (LRV/SP) = F(Inside, Controls)
\]  

(6)

Our dependent variable in Eq. (6) is the natural log of LRV/SP. We take the natural log of our dependent variable so that our data are not left-truncated at zero. Our treatment variable records whether the last round of financing was an Inside round. We also control for other factors that might affect the sale price and the last round valuation including:

- **VC Control** (which equals one if the VC’s control a majority of the board seats going into the new round of financing, and zero otherwise. VC control of the board may enable them to push through a financing that is more favorable to them);

- **California** (which equals one if the firm was incorporated in California, and zero otherwise. Compared to Delaware, California provides greater protection to minority shareholders, through separate class voting and threat of litigation (Broughman and Fried, 2010). Consequently, incorporation in California may limit a VC’s ability or willingness to push for a low valuation);
• $\Delta$ NASDAQ Sale (%): This is the percentage change in NASDAQ from the date of financing to the date of sale. This controls for factors that might affect the sale price but could not be foreseen by the parties on the date of financing;

• VC Reputation: This equals one if the VC firm leading the round of financing was formed prior to the median year of formation for the VCs in our sample (1990), and zero otherwise. This controls for possible investment discounts that may be awarded to VCs with a good reputation, as documented by Hsu (2004);

• Duration Fin. to Sale: This equals the period of time (in years) between the last round of financing and the sale of the firm; and

• Investment: This is the amount invested in the last round of financing (in millions).

Regression results are shown in Table 4. Model (4-1) reports univariate results, and in models (4-2) and (4-3) we add the above control variables and industry dummies.

In each specification we find a positive correlation between inside rounds and the LRV/SP ratio. This result is significant in most specifications. Relative to the sale price, firms are given a significantly higher valuation in inside rounds than in outside rounds.

To get a sense of the magnitude of this effect, consider model (4-2) evaluated at the median value of LRV/SP = 1.60. In model (4-2) the coefficient estimate for $\text{Inside} = 0.942$. We can use this information to calculate the marginal effect of inside financing – $x$ – given by the following:

$$\log(1.60 + x) = \log(1.60) + 0.942 = \log(4.09)$$

$$x = 4.09 - 1.60 = 2.49$$

From Eq. (8) we find that inside financing is associated with an increase of 2.49 in LRV/SP. Given that the median sale price for firms receiving inside financing in their last round is $11.5$ million, model (4-2) predicts that a firm’s nominal valuation will be about $29$ million higher ($= 11.5 \times 2.49$) if the last round of financing was an inside round as opposed to an outside round.

Inside financing has an economically (and statistically) significant effect on valuation. These results are consistent with predictions of our rescue financing theory that inside investors will tend to offer higher valuations than outside investors are willing to provide.

Our results could be biased by omitted variables that correlate with both the use of inside financing and high valuations. Ideally we would instrument for the use of inside financing. However, a good instrument is simply not available. We attempt to minimize this bias by looking at valuation relative to the firm’s ultimate sale price (LRV/SP). Omitted variables correlated with Inside are only a concern to the extent that they may cause the investors to incorrectly value the firm relative to its sale price.

Our theory predicts that existing VCs may choose to do a follow-on financing at a higher valuation than is available from an outside investor to reduce down-round costs. This higher value inside financing could in principle, be a down, even-, or (slightly) up-round. But inside rounds are more likely to be done to reduce down-round costs when they are done at a down or even valuation than when they are done at a higher valuation than the previous round. In model (4-4) we thus limit our analysis to the sub-sample of 33 firms where the last round of financing was a down or even round. Our theory for inside financing applies particularly to this subsample. Model (4-4) shows a similar coefficient for inside financing. Inside rounds are overvalued in the subsample of
down & even rounds. The result is statistically different from zero at the 12% level, but not at conventional levels.  

Finally, we address the possibility that outliers drive our results. Given our small sample size, one or two observations could have a large affect on the coefficient estimates reported in table 4. To address this concern we re-estimate models (4-1) and (4-2) using robust regression (‘RREG’). This approach assigns weights to each observation in order to reduce the effect of outliers and then re-estimates on the weighted observations. Our results are reported in models (4-6) and (4-7). While the precise coefficient estimates do change, we find the same basic result: inside financing has a positive and significant affect on the relative valuation assigned to a startup firm. This suggests that our results are not driven by outliers.

4.3. Round Returns: Inside versus Outside

Finally, our rescue financing theory we predict that inside rounds will tend to yield lower returns than outside rounds. Figure 4 shows the VCs’ internal rate of return (Round IRR) for each round of follow-on financing based on the time of financing. Figure 4 shows – using a Lowess curve for inside and outside – that inside rounds have a lower IRR over almost the entire time period.

Using multivariate regression, we estimate Round IRR as a function of inside financing. We use the same set of control variables found in models (4-2) through (4-5). Table 5 reports results.

[INSERT TABLE 5 HERE]

Inside rounds perform worse than outside rounds. This result is statistically significant in most models, and the effect is economically meaningful. Round IRR is estimated to be between .30 to .60 lower in inside rounds than in outside rounds.

Appendix: Selection Bias

This table compares our research sample to the population of Silicon Valley firms sold in 2003 or 2004. Data is from the VentureXpert profile for each firm. VentureXpert has data on 44 out of the 45 firms in our sample, and 170 out of the 193 firms in the total population. We can only compare firms that are within VentureXpert. Reported values are sample means. We use a difference of means t-test to compare characteristics of the sample firms to the full population.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Population (n=170)</th>
<th>Research Sample (n=44)</th>
<th>Difference of Means</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Invested (Millions $)</td>
<td>46.15</td>
<td>42.63</td>
<td>-3.52</td>
<td>0.560</td>
</tr>
<tr>
<td>Total Number of Investors</td>
<td>15.19</td>
<td>14.52</td>
<td>-.67</td>
<td>0.708</td>
</tr>
<tr>
<td>Year Founded</td>
<td>1997.23</td>
<td>1998.37</td>
<td>1.14**</td>
<td>0.018**</td>
</tr>
</tbody>
</table>

The lack of statistical significance at the 10% level or better is likely due to the small number of firms (n=33) in the down and even subsample.
Bibliography


Bengtsson & Sensoy, 2009 Changing the Nexus: The Evolution and Renegotiation of Venture Capital Contracts, SSRN: ---


VentureOne Deal Terms Report, 3rd Edition (Dow Jones, 2005)

Woronoff and Rosen, 2005 ... Effective vs. Nominal Valuations in Venture Capital Investing
Table 1: Description of the Dataset
This table provides descriptive statistics for a sample of 45 Silicon Valley VC-backed firms sold in 2003 or 2004. Panel A shows industry distribution, based on sector classification provided by [www.linksv.com](http://www.linksv.com). Panel B reports summary statistics for the for the sample firms.

**Panel A: Industry Distribution of Companies**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Biotech</th>
<th>Telecom</th>
<th>Software</th>
<th>Internet</th>
<th>Other IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Firms (n=45)</td>
<td>6</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

**Panel B: Firm Overview**

<table>
<thead>
<tr>
<th></th>
<th>Obs</th>
<th>Count</th>
<th>Mean</th>
<th>Med.</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Operation</td>
<td>45</td>
<td></td>
<td>5.13</td>
<td>5</td>
<td>1.65</td>
</tr>
<tr>
<td>Year Founded</td>
<td>45</td>
<td></td>
<td>1998.38</td>
<td>1998</td>
<td>1.77</td>
</tr>
<tr>
<td>Number of Financing Rounds</td>
<td>45</td>
<td></td>
<td>3.00</td>
<td>3</td>
<td>1.01</td>
</tr>
<tr>
<td>Total Invested (millions $)</td>
<td>45</td>
<td></td>
<td>43.99</td>
<td>31</td>
<td>37.65</td>
</tr>
<tr>
<td>Sale Price (millions $)</td>
<td>45</td>
<td></td>
<td>55.22</td>
<td>22</td>
<td>108.95</td>
</tr>
<tr>
<td>Firm IRR</td>
<td>45</td>
<td></td>
<td>0.20</td>
<td>-0.13</td>
<td>2.03</td>
</tr>
<tr>
<td>Profitable</td>
<td>45</td>
<td>16</td>
<td>0.36</td>
<td>0</td>
<td>0.48</td>
</tr>
<tr>
<td>Number of Founders</td>
<td>45</td>
<td></td>
<td>2.31</td>
<td>2</td>
<td>1.24</td>
</tr>
<tr>
<td>Serial Entrepreneur</td>
<td>45</td>
<td>20</td>
<td>0.44</td>
<td>0</td>
<td>0.50</td>
</tr>
<tr>
<td>Prior Experience with VC</td>
<td>45</td>
<td>23</td>
<td>0.51</td>
<td>1</td>
<td>0.51</td>
</tr>
<tr>
<td>California Incorporation</td>
<td>45</td>
<td>14</td>
<td>0.31</td>
<td>0</td>
<td>0.47</td>
</tr>
<tr>
<td>Delaware Incorporation</td>
<td>45</td>
<td>31</td>
<td>0.69</td>
<td>1</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Table 2: Variable Definitions and Correlation Matrix
This table defines the round-level variables for a sample of 45 Silicon Valley VC-backed firms sold in 2003 or 2004. The following correlation matrix shows the mean, and pairwise correlations among the variables in our sample. Data are only presented for 90 follow-on rounds of financing. First round financing is excluded since it does not apply to many of the variables below.

VC Control equals 1 if the VCs control the board immediately preceding a round of financing and 0 otherwise; Inside equals 1 if a new round of financing is provided entirely by a firm’s existing investors and 0 otherwise; VC * Inside is an interaction term equal to VC Control * Inside; Participation Right equals 1 if a round of financing includes participation rights for the VC’s preferred stock and 0 otherwise; LP multiple equals the liquidation preference multiple (i.e. 1x, 2x, etc.) in the current round of financing; Up equals 1 if a round of financing has a higher pre-money valuation than the post-money valuation of the previous round and 0 otherwise; Down equals 1 if a round of financing has a lower pre-money valuation than the post-money valuation of the previous round and 0 otherwise; Flat equals 1 if a round of financing has the same pre-money valuation as the post-money valuation of the previous round and 0 otherwise; Valuation Change equals the pre-money valuation of the current round minus the post-money valuation of the previous round (recorded on an implied basis); Investment equals the amount invested (in millions) in a round of financing; Round IRR equals the internal rate of return for each round of VC financing; Post Bubble Round equals 1 if a round occurred in 2001 or later and 0 otherwise; Round Number equals the number of the current round; Duration Financing to Sale equals the number of years between the current round of financing and the sale of the firm; Last Financing Round equals 1 if the current round is a firm’s last round of financing before the sale of the business.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 VC Control</td>
<td>.23</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Inside</td>
<td>.29</td>
<td>.23</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 VC*Inside</td>
<td>.10</td>
<td>.60</td>
<td>.52</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Up</td>
<td>.50</td>
<td>-.13</td>
<td>-.54</td>
<td>-.26</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Down</td>
<td>.34</td>
<td>.15</td>
<td>.31</td>
<td>.15</td>
<td>-.72</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Even</td>
<td>.16</td>
<td>-.02</td>
<td>.34</td>
<td>.16</td>
<td>-.43</td>
<td>-.31</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Valuation Change</td>
<td>-6.93</td>
<td>-.04</td>
<td>-.35</td>
<td>-.11</td>
<td>.58</td>
<td>-.48</td>
<td>-.17</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Investment</td>
<td>16.46</td>
<td>-.06</td>
<td>-.20</td>
<td>-.13</td>
<td>.27</td>
<td>-.16</td>
<td>-.16</td>
<td>.34</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 LP Multiple</td>
<td>1.44</td>
<td>.22</td>
<td>.41</td>
<td>.35</td>
<td>-.42</td>
<td>.43</td>
<td>.01</td>
<td>-.55</td>
<td>-.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Participation Rights</td>
<td>.60</td>
<td>-.03</td>
<td>.12</td>
<td>.12</td>
<td>-.14</td>
<td>.16</td>
<td>-.03</td>
<td>-.20</td>
<td>.17</td>
<td>.22</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Round IRR</td>
<td>-.04</td>
<td>-.01</td>
<td>-.01</td>
<td>-.09</td>
<td>.03</td>
<td>.07</td>
<td>-.28</td>
<td>-.11</td>
<td>.14</td>
<td>.14</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Post Bubble Rd.</td>
<td>.60</td>
<td>.18</td>
<td>.27</td>
<td>.20</td>
<td>-.50</td>
<td>.50</td>
<td>.04</td>
<td>-.46</td>
<td>-.22</td>
<td>.36</td>
<td>.17</td>
<td>.33</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Round Number</td>
<td>2.74</td>
<td>.22</td>
<td>.27</td>
<td>.18</td>
<td>-.24</td>
<td>.38</td>
<td>-.16</td>
<td>-.30</td>
<td>.18</td>
<td>.19</td>
<td>.13</td>
<td>.08</td>
<td>.26</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Duration Fin to Sale</td>
<td>2.63</td>
<td>-.27</td>
<td>-.26</td>
<td>-.25</td>
<td>.35</td>
<td>-.40</td>
<td>.04</td>
<td>.35</td>
<td>.03</td>
<td>-.35</td>
<td>-.15</td>
<td>-.44</td>
<td>-.75</td>
<td>-.34</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>15 Last Financing Rd.</td>
<td>.49</td>
<td>.14</td>
<td>.26</td>
<td>.12</td>
<td>-.44</td>
<td>.51</td>
<td>-.05</td>
<td>-.44</td>
<td>-.19</td>
<td>.37</td>
<td>.32</td>
<td>.46</td>
<td>.66</td>
<td>.34</td>
<td>-.69</td>
<td>-</td>
</tr>
</tbody>
</table>
Figure 1: Inside versus Outside Financing sorted by Round Number
Figure 1 illustrates the use of inside and outside financing sorted by the round number. The data are from a sample of 45 VC-backed firms sold in 2003 or 2004, covering 90 follow-on rounds of investment. This graph illustrates that inside rounds are more likely if the firm has already received several rounds of financing.
Figure 2: Inside Financing by Year
Figure 2 illustrates the use of inside rounds and down rounds based on the time of financing. The data are from a sample of 45 VC-backed firms sold in 2003 or 2004, covering 90 follow-on rounds of investment. The top portion of the diagram graphs the NASDAQ weekly closing price from the beginning of 1997 to the end of 2003. The bottom portion of the diagram uses a Lowess curve to plot the likelihood of inside financing and down-round financing over the same time period. Below the graph is a table reporting the fraction of the follow-on rounds that were inside and down-rounds for each year.

<table>
<thead>
<tr>
<th>Year of Financing</th>
<th>≤1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside</td>
<td>0.33</td>
<td>0.00</td>
<td>0.17</td>
<td>0.29</td>
<td>0.47</td>
<td>0.45</td>
</tr>
<tr>
<td>Down</td>
<td>0.17</td>
<td>0.00</td>
<td>0.06</td>
<td>0.42</td>
<td>0.63</td>
<td>0.55</td>
</tr>
</tbody>
</table>
Table 3: Market Condition and the Use of Inside Rounds

This table reports Logit regressions on a sample of 45 VC-backed firms sold in 2003 or 2004, covering 90 follow-on rounds of financing. The dependent variable (Inside) equals one if the round was an inside round, and zero otherwise. Our key explanatory variables (Δ NASDAQ (%) and Δ NASDAQ) measure the change in NASDAQ market prices from the previous round to the current round of financing. All other explanatory variables are defined in Table 2. The unit of analysis is the follow-on round of financing, and consequently there are multiple observations for several firms. Robust (White, 1980) standard errors, clustered at the firm level, are reported in parentheses below each coefficient estimate. We use a two-sided test for statistical significance.

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>(3-1)</th>
<th>(3-2)</th>
<th>(3-3)</th>
<th>(3-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ NASDAQ (%)</td>
<td>-.694*</td>
<td>-.716*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.401)</td>
<td>(.385)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ NASDAQ</td>
<td>-.00039**</td>
<td>-.00040**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.00019)</td>
<td>(.00019)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round Number</td>
<td>.578*</td>
<td>.575*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.339)</td>
<td>(.337)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC Control</td>
<td>.940</td>
<td>.908</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.587)</td>
<td>(.593)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-1.179</td>
<td>-1.133</td>
<td>-3.089</td>
<td>-3.020</td>
</tr>
</tbody>
</table>

Wald Chi2              | 2.99 | 3.99 | 10.62 | 11.24 |
Prob>Chi2              | 0.083| 0.045| 0.014 | 0.010 |
No. of Observations    | 90   | 90   | 90    | 90    |
No. of Firms (clusters)| 45   | 45   | 45    | 45    |

*= 10% significance; **=5% significance; ***=1% significance [2-sided test]
Figure 3: Last Round Valuation over Sale Price
Figure 3 illustrates the ratio of the (Last Round Valuation)/(Sale Price) (‘LRV/SP’) from a sample of 45 VC-backed firms sold in 2003 or 2004. Data are sorted based on whether the last round was an inside round or an outside round. The diagram below illustrates the distribution of LRV/SP for inside rounds and outside rounds using a standard box plot (with outlier values excluded).
Table 4: Regression Analysis of Valuation: Inside versus Outside Financing
This table reports ordinary least squares (OLS), weighted least squares (WLS), and robust regression (RREG) estimates on a sample of 45 VC-backed firms sold in 2003 or 2004. The dependent variable is Log Last Round over Sale, which measures the log of the ratio of the last round valuation (nominal) to the sale price. The unit of analysis is the last round of financing, and consequently there is only one observation for each firm. The treatment variable record whether the last round of financing was an inside round. All remaining explanatory variables are defined in Table 2. The WLS estimates reported in model (4-5) are weighted base the amount invested in the round. Robust (White, 1980) standard errors are reported in parentheses below each coefficient estimate. We use a two-sided test for statistical significance.

<table>
<thead>
<tr>
<th>Treatment Variable</th>
<th>OLS (4-1)</th>
<th>OLS (4-2)</th>
<th>OLS (4-3)</th>
<th>WLS (4-4)</th>
<th>WLS (4-5)</th>
<th>RREG (4-6)</th>
<th>RREG (4-7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside</td>
<td>.912**</td>
<td>.942**</td>
<td>.800*</td>
<td>.898</td>
<td>1.127*</td>
<td>1.002***</td>
<td>1.078***</td>
</tr>
<tr>
<td></td>
<td>(.447)</td>
<td>(.461)</td>
<td>(.469)</td>
<td>(.568)</td>
<td>(.577)</td>
<td>(.350)</td>
<td>(.352)</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC Control</td>
<td>1.563***</td>
<td>1.760***</td>
<td>1.953***</td>
<td>1.441**</td>
<td>1.005**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.580)</td>
<td>(.591)</td>
<td>(.659)</td>
<td>(.674)</td>
<td>(.392)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>.980**</td>
<td>.983***</td>
<td>.688</td>
<td>1.089**</td>
<td>.669*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.419)</td>
<td>(.349)</td>
<td>(.461)</td>
<td>(.408)</td>
<td>(.393)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ NASDAQ Sale (%)</td>
<td>-.213</td>
<td>-.352</td>
<td>-.146</td>
<td>-.795</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.693)</td>
<td>(.626)</td>
<td>(.980)</td>
<td>(.731)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC Reputation</td>
<td>-.394</td>
<td>-.052</td>
<td>-.053</td>
<td>-1.050*</td>
<td>-.433</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.455)</td>
<td>(.404)</td>
<td>(.541)</td>
<td>(.595)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration Fin to Sale</td>
<td>.540**</td>
<td>.541**</td>
<td>.790**</td>
<td>.451*</td>
<td>.501*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.216)</td>
<td>(.207)</td>
<td>(.305)</td>
<td>(.253)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>.009</td>
<td>.017</td>
<td>-.001</td>
<td>.013</td>
<td>.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.024)</td>
<td>(.018)</td>
<td>(.021)</td>
<td>(.020)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Dummies</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>.237</td>
<td>-1.337</td>
<td>-1.182</td>
<td>-1.793</td>
<td>-1.960</td>
<td>-.085</td>
<td>-1.323</td>
</tr>
<tr>
<td></td>
<td>(.286)</td>
<td>(.524)</td>
<td>(.549)</td>
<td>(.693)</td>
<td>(.719)</td>
<td>(.222)</td>
<td>(.571)</td>
</tr>
</tbody>
</table>

R² = .09 | .43 | .56 | .44 | .51 | - | - | -
F-stat = 8.19 | 3.26
No. of Observations = 45

*= 10% significance; **=5% significance; ***=1% significance [2-sided test]

24 The results reported in this table are unaffected by the method of valuation. We find similar results if we use implied valuations (Metrick, 2007) instead.
Table 5: Regression Analysis of Round IRR: Inside versus Outside Financing

This table reports ordinary least squares (OLS), weighted least squares (WLS), and robust regression (RREG) estimates on a sample of 45 VC-backed firms sold in 2003 or 2004, covering 90 rounds of follow-on financing. The dependent variable is Round IRR and the treatment variable is inside. All remaining explanatory variables are defined in Table 2. The unit of analysis is the follow-on round of financing, and consequently there are multiple observations for several firms. Robust (White, 1980) standard errors, clustered at the firm level, are reported in parentheses below each coefficient estimate. We use a two-sided test for statistical significance.

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>RREG</th>
<th>WLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment Variable</strong></td>
<td>(5-1)</td>
<td>(5-2)</td>
<td>(5-3)</td>
</tr>
<tr>
<td>Inside</td>
<td>-.377*</td>
<td>-.401*</td>
<td>-.306</td>
</tr>
<tr>
<td></td>
<td>(.215)</td>
<td>(.215)</td>
<td>(.290)</td>
</tr>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC Control</td>
<td>-.187</td>
<td>-.243</td>
<td>-.304</td>
</tr>
<tr>
<td></td>
<td>(.304)</td>
<td>(.286)</td>
<td>(.454)</td>
</tr>
<tr>
<td>California</td>
<td>.265</td>
<td>.160</td>
<td>.696</td>
</tr>
<tr>
<td></td>
<td>(.263)</td>
<td>(.228)</td>
<td>(.455)</td>
</tr>
<tr>
<td>Δ NASDAQ Sale (%)</td>
<td>.711**</td>
<td>.492*</td>
<td>1.070*</td>
</tr>
<tr>
<td></td>
<td>(.323)</td>
<td>(.271)</td>
<td>(586)</td>
</tr>
<tr>
<td>VC Reputation</td>
<td>.105</td>
<td>.058</td>
<td>-.133</td>
</tr>
<tr>
<td></td>
<td>(.169)</td>
<td>(.172)</td>
<td>(263)</td>
</tr>
<tr>
<td>Duration Fin to Sale</td>
<td>-.295***</td>
<td>-.367***</td>
<td>-.340*</td>
</tr>
<tr>
<td></td>
<td>(.085)</td>
<td>(.090)</td>
<td>(171)</td>
</tr>
<tr>
<td>Invested in Round</td>
<td>-.004</td>
<td>-.008</td>
<td>-.011</td>
</tr>
<tr>
<td></td>
<td>(.004)</td>
<td>(.005)</td>
<td>(.022)</td>
</tr>
<tr>
<td>Industry Dummies</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>.887</td>
<td>.893</td>
<td>.942</td>
</tr>
<tr>
<td></td>
<td>(.375)</td>
<td>(.398)</td>
<td>(.716)</td>
</tr>
</tbody>
</table>

R² = .29  .39  .31  -  .41
F-stat = -  -  -  4.08  -
No. of Observations = 90  90  45  90  90
No. of Firms (clusters) = 45  45  33  -  45

*= 10% significance; **=5% significance; ***=1% significance [2-sided test]
Figure 4: Round IRR over Time of Financing
This graph shows the IRR for each follow-on round of financing in a sample of 45 VC-backed firms sold in 2003 or 2004, covering 90 rounds of follow-on rounds. Outside rounds are indicated with blue dots while inside rounds are indicated with red dots. The graph also shows a Lowess curve plotting the IRR over time for outside rounds (green curve) and for inside rounds (orange curve).